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SPACE FRAMES

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(57) Claim

1. A space frame of the type having, at a node, a set of three chord members converging in substantially equiangularly spaced relationship, wherein:

each chord member terminates in a flat attachment plate, its extremity mitred for co-planar convergent interfitment of the plates, and

a set of strut members also with adjacently located flat terminals each oblique to the main part of its strut member and secured, in superimposed relationship with the chord member attachment plates, by bolts or other connector means through the chord attachment plates and the strut terminals, the connector means interconnecting the members of the two sets.

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COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

SPACE FRAMES

The following statement is a full description of the invention including the best method of performing it known to the applicant.

THIS INVENTION relates to space frames.

Although space frames of double-layer flat squared grid type are well-known and widely used, other configurations of space frame are preferred or required in certain applications. For example, a space frame of domed or barrel-vault form may have an outer layer or sub-frame of contiguous triangles and an inner layer of hexagons. In the outer layer, then, six chords lead from a node, or common apical point of six contiguous triangles, and in the inner layer three chords lead from each node or common point of three contiguous hexagons. The nodes of outer and inner layers are inter-connected by oblique web members or struts.

Alternatively, the outer and the inner layers or sub-frames of a space frame which is of double-layer flat type, instead of domed or vaulted form, may also be built up of contiguous triangles and/or hexagons, the nodes of the two sub-frames being interconnected by oblique struts.

The present invention has been devised with the general object of providing a space frame which may be of any of the foregoing types, and it resides broadly in a space frame of the type having, at a node, a set of three chord members converging in substantially equiangularly spaced relationship, wherein each chord member terminates in a flat attachment plate, its extremity mitred for co-planar convergent interfitment of the plates; and a set of strut members also with adjacently located flat terminals each oblique to the main part of its strut member and secured, in superimposed relationship with the chord member attachment plates, by bolts or other connector means through the chord attachment plates and the strut terminals, the connector means interconnecting the members of the two sets. The set of three chord members may have their attachment plates superimposed on those

of a second similar set so that the six chords at the node are spaced at equal angles, which are bisected by a like number of strut members, the adjacent terminals of which are mitred to 60°. Other features of the invention will become apparent from the following description.

Preferred embodiments of the invention are shown in the accompanying drawings, wherein:-

FIG.1 is a plan view of the contiguous ends of a first set of three convergent chord members,

FIG. 2 is a plan view of the contiguous ends of a second set of three convergent chord members,

FIG. 3 shows in plan view the two sets of chord members, their extremities in superimposed relationship,

FIG. 4 is a plan view of a completed node comprised of the two superimposed sets of chord members connected to each other and to a set of oblique strut members, and

FIG. 5 is a plan view of a completed node according to a modification of the invention in which three convergent chord members are connected to each other.

Referring initially to FIGS. 1 to 4 of the drawings, a first set of three chord members 10 meet at angles of 120°, and a second set of three chord members 10a also meet at angles of 120°. Each of the chord members is of steel tube which at each end is flattened to form a shoulder at 11 defining the inner end of a flat end plate 12 the outer extremity of which is mitred at an angle of 120°, and is formed with two bolt holes 13.

When the flat end plates 12 of three chord members 10 or 10a are brought together in co-planar relationship, the mitred edges of contiguous end plates are brought together, the chord members are at angles of 120° and the six bolt holes 13 are in equally spaced

relationship and equally spaced from the common junction point of the three end plates.

as shown in FIG. 3, the two sets of chord members 10 and 10a are superimposed, those of the second set being angularly displaced by 60° relative to those of the first set, the bolt holes 13 of the two sets being so disposed that they are then brought into register.

The node is completed, as shown in FIG. 4, by the addition of six oblique struts 14 and the rigid interconnection of all the parts. Each of the struts 14 is of steel tube of lesser diameter than the chords 10 and 10a, and each is flattened at each end to form a shoulder 15 defining the inner end of a flat terminal plate 16 oblique to the axis of the main tubular part of the strut 14. The terminal 16 is mitred to an angle of 60° and is formed with a single bolt hole. When the strut terminals 16 are superimposed on the assembly of sets of chord members 10 and 10a, the mitred edges of the terminals 16 are brought together, and their bolt holes are brought into alignment with the bolt holes 13 of the chord members end plates 12, so that the whole assembly may be rigidly interconnected by bolts 17 passed through the aligned bolt holes and engaged by nuts 18.

It may be preferred to reinforce the node by the use of hexagonal load distribution plates (not shown) positioned under the end plates 12 of the second set of chord members 10a and over the adjacent terminals 16 of the struts 14, the load distribution plates being formed with bolt holes to accept the bolts 17.

The node described and illustrated is applicable to a first sub-frame of chords 10 and 10a arranged as contiguous equilateral triangles, the second sub-frame of the structure being in the form of contiguous hexagons, the struts 14 interconnecting the nodes of the two sub-frames.

In the second sub-frame each node is, as shown in FIG. 5, at the convergence of three only chord members 10b, and so the superimposition of two sets of these chord members is not required, and a single set suffices. To such a node too, three, not six, of the struts 14 are convergent and so the terminal plates 19 formed at these convergent ends of the struts are mitred for adjacent interfitment and formed with two bolt holes, similarly to the end plates of the chord members, and with such modification as is consequent upon the lesser diameter of the struts. Again, six bolts 17 serve to interconnect rigidly the three chord members 10b and the three struts 14 of the mode.

In the space frame, all of the struts 14 may be similar, all the chord members 10 and 10a of the first sub-frame may be similar and all of the chord members 10b making up the hexagons of the second sub-frame may be similar. At each node, of either sub-frame, the parts are firmly held together by six bolts and nuts. Consequently the space frame will be found to be simple and economical to manufacture and erect.

Although space frames according to the embodiment herein described and illustrated will be found to be effective in achieving the objects for which it has been devised, it will, of course, be understood that many modifications of constructional detail and design, which will be readily apparent to skilled persons, may be made within the scope of the invention hereinafter claimed.

The claims defining the invention are as follows:

1. A space frame of the type having, at a node, a set of three chord members converging in substantially equiangularly spaced relationship, wherein:

each chord member terminates in a flat attachment plate, its extremity mitred for co-planar convergent interfitment of the plates, and

a set of strut members also with adjacently located flat terminals each oblique to the main part of its strut member and secured, in superimposed relationship with the chord member attachment plates, by bolts or other connector means through the chord attachment plates and the strut terminals, the connector means interconnecting the members of the two sets.

2. A space frame according to Claim 1 wherein:

the set of three chord members have their attachment plates superimposed on those of a second similar set of chord members, the six chords at the node being spaced at equal angles which are bisected by a like number of oblique strut members the terminals of which are mitred for close adjacent co-planar interfitment.

3. A space frame according to either of the preceding claims wherein:

the chord members are of metal tube with ends, at the node, flattened and mitred to 120° to form the flat attachment plates.

4. A space frame according to any one of the preceding claims wherein:

the strut members are of metal tube with ends, at the node, flattened to form the flat terminals and mitred for close adjacent co-planar interfitment.

5. A space frame according to any one of the preceding claims wherein:

substantially hexagonal load distribution plates are located adjacent to the chord member end plates and the

strut member terminals and secured by the connector means.

6. A space frame including nodes substantially as herein described with reference to FIGS. 1, 2, 3 and 4.

7. A space frame including nodes substantially as herein described with reference to FIG. 5 of the accompanying drawings.

DATED this twenty second day of December 1988.

HARLEY SYSTEMS PTY LTD
by their Patent Attorneys
GRANT ADAMS & COMPANY

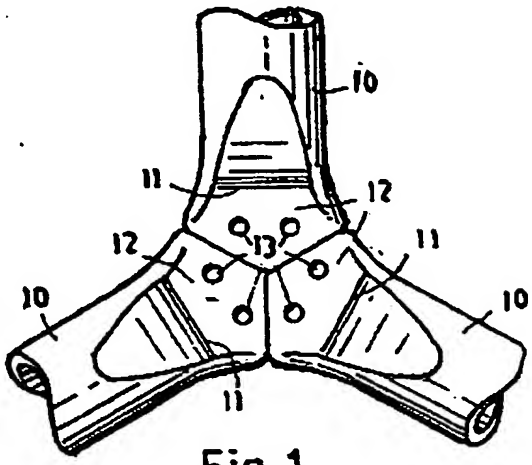


Fig. 1.

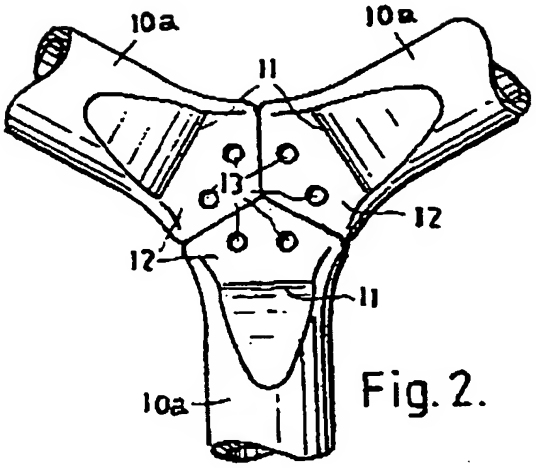


Fig. 2.

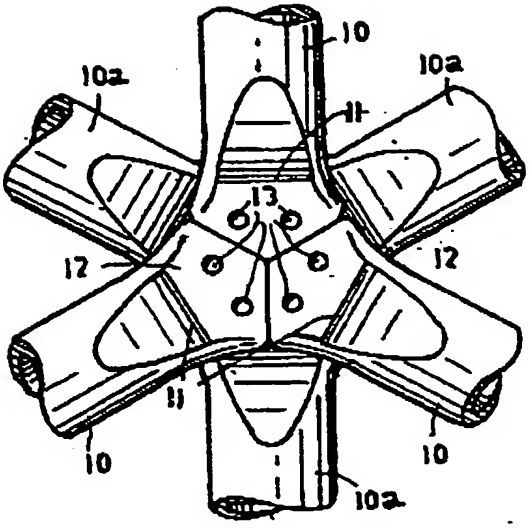


Fig. 3.

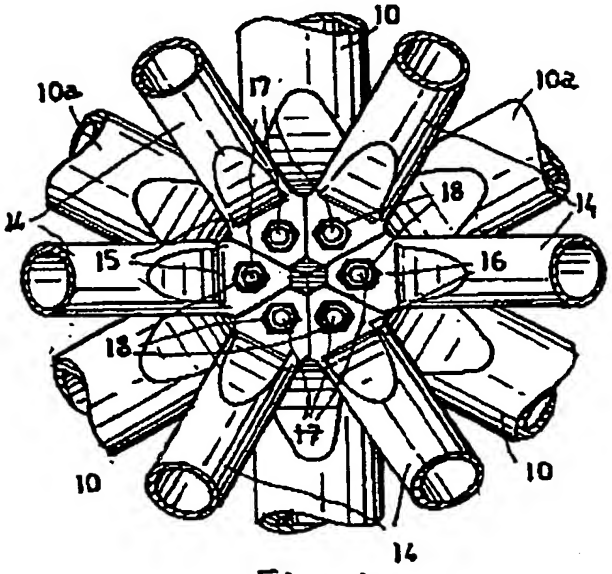
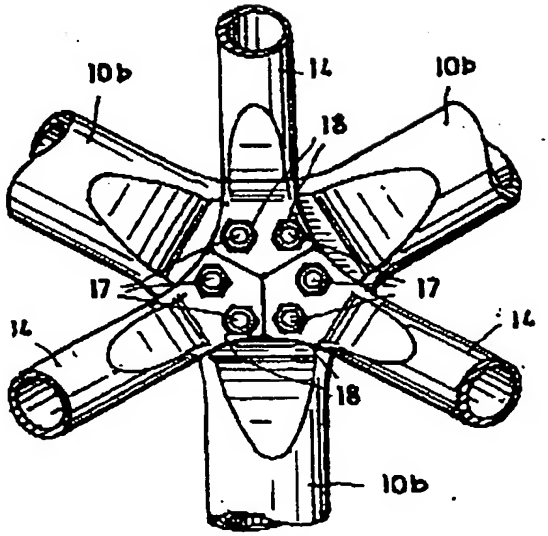


Fig. 4.



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